THE SHORT-TAILED HAWK IN FLORIDA
I. MIGRATION, HABITAT, HUNTING TECHNIQUES, AND FOOD HABITS

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THE most recent summaries of life history data for the Short-tailed Hawk (*Buteo brachyurus*) are by Moore et al. (1953), Rand (1960), and Brown and Amadon (1968). These authors reveal the absence of any comprehensive study of this species, which is not surprising in view of its apparent scarcity and its tropical and subtropical distribution (in this paper I exclude the mountain form, *B. b. albigula*, which may be specifically distinct). In the United States, Short-tails occur only in Florida, the northernmost outpost for the species. Although they are certainly less common in Florida than in some parts of Mexico, Central America, or South America, most of the sparse data on Short-tails is from Florida. I know of 13 Short-tailed Hawk nests found previously in Florida (Brandt 1924, Howell 1932, Sprunt 1939, Nicholson 1951, Robertson pers. comm.), a few nests in Mexico (Veracruz, Wolfe pers. comm.; "Altillo," eggs on 26 March 1907, J. A. Weber coll.), and 2 nests in Trinidad (Herklots 1961; eggs collected by Smooker, 20 May 1938, *fide* Wolfe), but none of these was closely studied. In 1965 I became aware of places in southern Florida where Short-tailed Hawks occur regularly, and so designed a field study to collect a broad range of life history data on the species. In this paper I report on intra-Florida migration, habitat, hunting techniques, and food habits. Other aspects of the species' life history, primarily breeding biology, will be reported in a later paper.

STUDY AREA AND METHODS

Life history data were collected at irregular intervals between February 1966 and June 1972, primarily in the vicinity of Paradise Key and the Palma Vista Hammocks in eastern Everglades National Park, Dade County, Florida, and near Fisheating Creek, Glades County, Florida. I collected regurgitated food pellets and portions of uneaten food at the following active nests: three nests at the Palma Vista Hammocks built by a dark-phase male mated to a white-phase female in 1966, and by the same male mated to a dark female in 1970 and 1971; a nest near "Hutto Cow Camp" east of Palmdale, Glades County, built by a pair of dark-phase adults in 1968; and nests at Rock Lake Cypress, Glades County, in the 3 years 1970 through 1972, built by a pair of white-phase birds. To provide a qualitative and rough quantitative measure of food habits, food remains from these nests were identified by comparison with museum specimens. An understanding of hunting techniques plus additional food habit data were acquired during about 125 hours of field study of hunting Short-tailed Hawks, where individual hawks were watched continuously for periods of 1 to 5 hours on 35 different days.

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INTRA-FLORIDA MIGRATION

The existence of migration by Short-tailed Hawks within Florida has not been previously reported, although Moore et al. (1953) noted what appeared to be seasonal variation in the species' abundance in Florida, with 119 out of 124 known sightings having occurred from September through April. These authors suggested that the scarcity of summer observations is caused by the Short-tailed Hawks that winter in Florida moving outside the state during the summer. Rand (1960) questioned this explanation when he was able to show slight color and size differences between Florida specimens and those taken in Mexico and Central America. I also believe that the Florida population is disjunct, and that Short-tailed Hawks were previously overlooked in summer because of intra-Florida migration, which spreads this small population thinly through the state in summer and concentrates it in the southern tip of the peninsula in winter.

Short-tailed Hawks that I observed nesting at two southern Florida locations, Everglades National Park and near Fisheating Creek, were found in the vicinity of their nesting sites in all months, and may be considered resident at these sites. Yet obviously many more Short-tailed Hawks are in south Florida in winter than in summer. During midwinter for example, I found between two and six Short-tails daily near Flamingo, Everglades National Park, where none occur in summer. A similar seasonality of these hawks occurs along several of the coastal river systems between Flamingo and Everglades City in Collier County, as well as in the Paradise Key region at the eastern edge of the park. First arrivals of nonresident Short-tailed Hawks near Paradise Key occurred on 14 October 1967, 15 October 1968, 18 October 1970, and 10 October 1971. I detected a migratory flight 1 November 1967, when I saw eight nonresident birds near Paradise Key. Two or three Short-tails, in addition to a resident pair, remained through each winter near Paradise Key and disappeared during early February each year from 1966 through 1971. The latest spring date for a nonresident adult at Paradise Key was 16 February 1966, while nonresident immature-plumaged Short-tails remained until 22 March 1966 and 16 March 1968.

Assuming mid-October and early February as primary migration periods for Short-tailed Hawks in Florida, I prepared two outline maps showing breeding season and winter ranges (Figure 1). One map shows locations for all reported nests, and for specimens and well-documented sight records for dates between 20 February and 1 October, while the second map shows specimen and sight records between 15 October

and 2 February. The sight records used on the maps are not a compilation of all known observations, but were selected to show the known sites of record for Short-tailed Hawks during the two seasons. These maps show an absence of winter records in northern and central Florida, and an increase in the number of places occupied in the southern peninsula during winter.

My interpretation of the overall record is that the Short-tailed Hawks nesting north of Lake Okeechobee move into southern Florida in October and return to their nesting grounds in February. As this movement occurs on predictable dates and involves all Short-tails that nest in central and north Florida, I consider the movement to represent true migration rather than dispersion (Thompson 1964). Possibly a few Short-tails continue south of Florida in the fall flights, as there are specimens from the lower Keys, and they have been reported mixed in with flights of other fall migrant buteos over Key West (Hundley and Hames 1960). Some confusion has existed in field identification of Short-tails in the Florida Keys because of the presence of occasional melanistic Broad-winged Hawks (*Buteo platypterus*) (Robertson 1967), so that the extent of Short-tailed Hawk migration and wintering in the Keys remains uncertain. No Short-tailed Hawks have been recorded from Cuba (Bond 1971) where Florida birds would be likely to appear, though admittedly a few there could be easily overlooked.

Short-tailed Hawks apparently are also migratory in Mexico and Central America, where small flocks were reported in mid-February in Honduras (Monroe 1968), and during "very early spring and late summer," as well as "late in the fall" in Costa Rica (Slud 1964). In Mexico, Andrle (1967) considered Short-tails to be migrating through southern Veracruz, and I noted differences in abundance in Colima, where I found none during a week in June 1971, but easily located two different dark-phase adults during January 1972.

Habitat in Florida

Short-tailed Hawks have been reported to be a swamp woodlands species in Florida (Brandt 1924, Howell 1932, Bent 1937). Moore et al. (1953) also considered that the Short-tail is a swampland species, and reported that 9 out of a total of 12 nests found in the state were in cypress or mangrove forests.

While Short-tails indeed are often associated with swamp woodlands, the species is not a woodland bird to the same degree as the Broad-winged Hawk or Sharp-shinned Hawk (*Accipiter striatus*). The Short-tails I watched apparently required stands of large trees (not necessarily swamps) for nesting and roosting, but invariably utilized forest

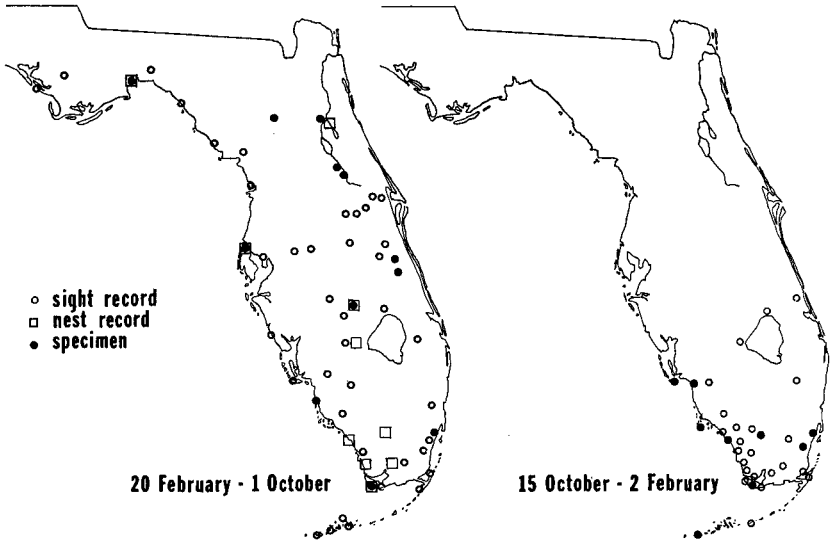

Figure 1. Seasonal distribution of Short-tailed Hawks in Florida. Nest and specimen records are from Ridgway 1881, Scott 1889, Pennock 1890, Swann 1922, Brandt 1924, Howell 1932, Bent 1937, Sprunt 1939, Nicholson 1951, Everglades National Park files, Field Museum of Natural History, Chicago; University of Miami, Coral Gables; Virginia Polytechnic Institute, Blacksburg; and this study. Sight records are from Howell 1932, Schroeder 1937, Kuerzi 1938, Sprunt 1939, Greene 1944, Davidson 1951, Nicholson 1951, Moore et al. 1953, Moore 1954, Snyder 1954, Ogden 1964, James 1965, Cunningham 1966, Page 1971, and notes from Christine Bonney, J. B. Edscorn, Frances Hames, J. Johnson, H. P. Langridge, F. Ligas, D. J. Nicholson, C. S. Olson, D. R. Paulson, C. Preston, W. B. Robertson, Jr., N. F. Snyder, A. Sprunt, Jr., H. M. Stevenson, L. A. Stimson, L. E. Williams, and G. E. Woolfenden.

edge and open country as primary hunting sites. Throughout Florida the species seems most common in mixed woodland-savannah habitats. The Fisheating Creek region of Glades County supports the greatest density of nesting Short-tails presently known, where three or four pairs are resident within 5 miles of the town of Palmdale. Fisheating Creek and its tributaries there are narrowly bordered by strands and isolated patches of cypress, long-needled pines, swamp hardwoods, and several species of evergreen oaks. These woodlands finger through expansive "prairies" and pastures dominated by saw palmetto (*Serenoa repens*), native grasses, and herbs. Two pairs of Short-tailed Hawks studied here built their nests in tall pine or cypress trees less than 75 m inside a stand of woods, and did most of their hunting over the prairie and brushland adjacent to their nesting sites.

The pair at the Palma Vista Hammocks also occupied a similar habitat and nested in tall pines 20 to 75 m inside the edge of a pine forest with dense hardwood understory. The adults hunted along the woodland edge and ranged out over adjacent sawgrass (*Cladium jamaicensis*) marsh. Approximately 65% of the hunting range of this male was everglades marsh or willow thicket, while the remainder was pine and hardwood forest.

I examined other sites where Short-tails were previously reported in spring or summer, Econlockahatchee River in Orange County, Lake Istakpoga and Parker's Island in Highlands County, Taylor Creek in Okeechobee County, Brighton Reservation in Glades County, and Corkscrew Swamp in Collier County, and found each to contain patches or strands of large trees adjacent to open country. The percentage of woodland cover at these sites varied from approximately 20% to 60% with the remaining lands being rather distinct open country plant communities such as rough pasture, marsh, or native prairie. Similarly, Short-tails I watched in the coastal mangrove zone of extreme southern Florida usually hunted over an interface between mangrove woods and marsh, or over mixed habitats of coastal prairie vegetation and mangroves (Craighead 1971).

Prey

Various authors have speculated that Short-tailed Hawks are opportunistic hunters with a nonspecific diet similar to that of most woodland buteos. Snakes, lizards, frogs, large insects, small mammals, small birds, and carrion have been listed as possible prey (Fisher 1893, Bailey 1925, May 1935, Bent 1937). Rand (1960) noted that Short-tails have heavier feet and longer claws than do other buteos of similar size, and he suggested that birds might be their principal prey.

Food habit data now available confirms that the Short-tailed Hawk is a specialized bird hunter. I identified 66 birds as prey items at the seven active nests listed above, and 29 birds and 3 rodents as prey taken by Short-tails during the time I watched these birds hunt. Two species, Eastern Meadowlark (*Sturnella magna*) and Red-winged Blackbird (*Agelaius phoeniceus*), made up over half of the identified bird prey. The little food habit data accumulated in Florida prior to my study is also presented (Table 1).

The following prey species and numbers of each were identified from the seven active nests: Bobwhite (*Colinus virginianus*) 2, Mourning Dove (*Zenaidura macroura*) 1, Ground Dove (*Columbigallina passerina*) 1, Yellow-billed Cuckoo (*Coccyzus americanus*) 3, Common Flicker (*Colaptes auratus*) 1, Tufted Titmouse (*Parus bicolor*) 1, Blue-grey Gnatcatcher (*Polioptila caerulea*) 1, White-eyed Vireo (*Vireo griseus*) 1,

TABLE 1
RECORDED OBSERVATIONS OF SHORT-TAILED HAWK PREY IN FLORIDA PRIOR TO THIS STUDY

Location	Date	Prey	Reference
Key West, Monroe Co.	17 January 1898	Bird remains in stomach of collected Short-tail "probably *D. palmarum*"	Collected by J. W. Atkins, Museum Comp. Zool. No. 249300
Near Orlando, Orange Co.	12 March 1911	Unidentified warbler	Unpublished field notes, D. J. Nicholson
Hollywood, Broward Co.	21 Sept. 1938	Red-winged Blackbird	Collected by Al Pflueger; University of Miami No. 192
Orange Co.	—	Sharp-shinned Hawk remains in stomach of collected Short-tail	Cottam and Knappen 1939
Near Auburndale, Polk Co.	15 May 1954	Small rodent, probably cotton rat	Moore 1954
Matheson Hammock, Dade Co.	April 1954	Redstart	D. R. Paulson pers. comm.
—	—	Carrying small snake	Sprunt 1955
Everglades Natl. Park	February 1965	Cotton rat	R. L. Cunningham pers. comm.

TOTAL: 5 birds (4 identified species), 2 rodents, 1 snake.

Black-whiskered Vireo (*Vireo altiloquus*) 1, Blackpoll Warbler (*Dendroica striata*) 1, American Redstart (*Setophaga ruticilla*) 2, Eastern Meadowlark 18, Red-winged Blackbird 20, Cardinal (*Richmondena cardinalis*) 3, Rufous-sided Towhee (*Pipilo erythrophthalmus*) 2, Seaside Sparrow (*Ammospiza maritima*) 2, Bachman's Sparrow (*Aimophila aestivalis*) 1, unidentified small birds 5.

The following were recorded as prey, either captured or intended, during field observations of hunting Short-tails: cotton rat (*Sigmodon hispidus*) 1, unidentified small rodents 2, Bobwhite 1, Killdeer (*Charadrius vociferus*) 1, Tree Swallow (*Iridoprocne bicolor*) 3, American Robin (*Turdus migratorius*) 1, Cedar Waxwing (*Bombycilla cedrorum*) 1, White-eyed Vireo 1, Eastern Meadowlark 2, Red-winged Blackbird 3, American Goldfinch (*Spinus tristis*) 4, unidentified small birds 12.

Short-tails apparently direct most of their hunting effort toward capturing adult birds. No nestling or newly fledged birds occurred among

the prey remains I examined in or below nests (n = 40), and I did not witness any form of hunting that appeared to be directed toward capture of nestlings.

Hunting Techniques

Short-tailed Hawks search for prey almost exclusively from the air during seemingly effortless soaring over the low relief terrain characteristic of peninsular Florida. They hunt at heights from 50 to more than 350 m, most commonly between 75 and 250 m. The hawks often employ one or a combination of the following three search techniques:

(1) Aerial still-hunting by spread-winged "balancing" on upward deflected air currents such as commonly occur along the windward edge of woodlands. A Short-tail may "hang" in one spot for a few seconds or for several minutes facing into the upward deflected wind, to search the woodland edge and open country below. The hunting bird may change its location regularly by sailing a short distance parallel with the woodland edge, then turn back into the wind to another holding position. Most of the hunting I watched in the vicinity of the three closely studied Short-tail nesting sites was by this technique, above long stretches of woodland-savannah interface. Five of the six sites listed above where Short-tails had previously been reported in summer also contained long woodland edges, and it may be that such a woodland-savannah interface is characteristic of most Short-tail nesting sites in Florida. Short-tails also hunt by this technique over almost any sort of terrain on windy days or where thermals are especially well-developed.

(2) Very slow soaring, generally working into the wind, searching for prey with head turned downward. After covering a distance of several hundred meters or more, the hawk may sail on bowed wings rather swiftly back over the ground just searched, or off to one side, and one or more times may make tight turns back into the wind, slow to a near stationary hold to search briefly below, then turn again to sail farther back. This form of hunting often occurs over uniform terrain where thermals or upward deflected currents necessary for aerial still-hunting are relatively poorly developed.

(3) Soaring in small circles, spiraling upward at various rates of climb, is a technique most often used to gain altitude. Circling may also be employed for maintaining altitude during hunting, particularly over relatively featureless terrain when there is little air movement.

Occasionally other forms of hunting are used:

(1) Immediately following unsuccessful attempts to capture prey, a Short-tail may alternately flap and sail in straight-line flight through tree tops in wooded areas, possibly employing the "direct search" tech-

nique described by Johnson and Peeters (1963). Generally these flights persist for only a few hundred meters before the hawk circles upward, and I have not seen birds try to capture prey in such flights.

(2) I have often seen Short-tailed Hawks perch on the very topmost, upright branch of a tree, so that only the head and upper body showed above clusters of broad leaves or needles. In such a position a hawk may preen or sun itself, and is able to see considerable distances across the tops of adjacent trees. I am not certain that capture attempts are initiated from such perches, although I once saw a female bird actively looking in all directions from such a perch at the top of a pine tree, and 30 minutes later found this same female at her nearby nest feeding prey to a nestling. This occurred about 07:30, before Short-tails ordinarily begin aerial hunting.

Aerial hunting usually begins about 2 to 3 hours after sunrise. This late start at hunting almost certainly is because the surface winds and thermals they need for efficient aerial maneuvering are seldom strongly developed until air temperature increases in midmorning. Apparently Short-tails stop hunting for the same reason during cooling late daylight hours, and are usually perched at or near woodland roosting sites 1 or 2 hours before sunset.

These hawks capture prey by stooping from the slow soaring or aerial still-hunting positions and, in doing so, routinely exhibit greater spirit and dash than I have seen in other buteos. The most frequently observed stoops are steep-angled dives, in which a Short-tail plummets head first with wings lifted well above the bird's dorsal surface, but with the primaries folded back against the body. Angles of descent during these fast stoops may vary between approximately 45 degrees and essentially 90-degree vertical drops, and the steeper ones are indeed spectacular. More complex maneuvers occur if the soaring bird sights prey well to one side of its flight path and has to sail swiftly to a spot directly over the prey before stooping in the usual manner. Stoops may continue straight to prey, or a bird may one or more times interrupt a dive by quickly opening its wings and going into a midair hold in a near stationary position similar to aerial still-hunting. They maintain such holds for several seconds, sometimes for longer periods up to 30 or 45 seconds, then may resume the stoop towards prey. At other times birds make almost imperceptibly slow parachute like descents with the body horizontal and wings spread, perhaps dropping vertically 10 to 50 m before folding back the wings for a faster approach. These interrupted stoops probably are useful in allowing an otherwise swiftly dropping hawk to adjust its approach to a bird that is moving in and out of sight in vegetation below.

Approximately 15 m or less above the intended prey, a Short-tail extends its talons, and when needed, spreads its wings to slow the descent and brings its body into a near horizontal position, so that prey is struck from above by the downward extended talons. No second strikes are attempted at missed prey, suggesting that once initial speed and surprise are lost pursuit has little value. Following unsuccessful strikes, hunting Short-tails quickly regain height by spiraling upward.

Of 160 stoops that I saw well enough to be certain of the location of the intended prey, 139 were directed toward prey perched in trees or shrubs situated either in woods or isolated in open fields, 15 were toward prey on or near open ground, and 6 toward low flying birds. Many of the meadowlarks and blackbirds taken were adults perched in lone shrubs in marshes or fields.

Hunting efficiency appears to be poor. During 30 hours of watching Short-tails engage in uninterrupted hunting on 17 different days, I recorded 107 stoops on prey, of which 64 appeared to be carried through to striking distance of prey, and 12 (11%) resulted in successful captures. The most successful rate of captures by an individual hawk was three birds taken in nine stoops during two midmorning hours of hunting along a long woodland-marsh interface in March 1966. The poorest hunting effort was in February 1967 at the same location, when nine stoops initiated during 1 hour and 45 minutes were all unsuccessful. I judged a capture attempt to be successful if the Short-tail circled back into view carrying prey following a stoop, or if the hawk remained down and perched out of my sight for 5 minutes or longer, a fairly certain indication that prey was eaten at the spot of capture. I was able on six occasions to locate a Short-tail that remained perched for several minutes after a stoop into trees or brush, and each was feeding on fresh prey. Because Short-tails almost certainly perch for prolonged periods after some unsuccessful stoops as well, the 11% estimate should be considered as a maximum rate of hunting success.

Prey capture stoops that terminate before a strike is attempted most often follow an escape movement by the intended prey, well before the hawk comes close. Several times I watched flocks of small birds take flight from tree tops when a stooping Short-tail was still several dozen meters above. Invariably the hawk interrupted its stoop with a midair hold, soon followed by circular soaring to regain height.

Hunting Range

I determined hunting range (as defined by Craighead and Craighead 1956: 15) for adult male Short-tails at three south Florida nesting sites and found four aspects common to each of these measured ranges:

(1) The total area each male hunted was larger than hunting ranges for the similar sized and sympatric Red-shouldered Hawk (*Buteo lineatus*). (2) Each range contained a long strip (> 0.5 mile) of woodland edge where deflected surface winds provided favorable conditions for aerial hunting. (3) Each site contained a stand of large trees with dense understory where the adult hawks roosted and had nests. (4) Each contained as large an expanse of brushland and open country as woods.

Maximum diameters for each of the three Short-tail ranges were 1.2, 1.5, and 1.6 miles. By comparison, maximum diameters for three measured Red-shouldered Hawk hunting ranges in south Florida, each maintained by adult males at nesting sites, were 0.3, 0.6, and 0.7 miles. I suspect that Short-tailed Hawks require hunting ranges larger than those of local Red-shouldered Hawks because of differences in the quantity of prey available to the two species. Craighead and Craighead (1956: 35) reported that the "abundance and availability of prey was a major factor influencing the size of range" of Michigan raptors. My observations in Everglades National Park and along Fisheating Creek indicate that the prey most often taken by local Red-shoulders (frogs, snakes, small mammals, turtles) were more numerous and more readily available than birds, and that individual Red-shoulders captured prey with greater frequency than did Short-tails.

It requires only a few days watching the Short-tails' hunting technique to recognize that woodland edge and open country are most important as hunting sites, and that they take a high percentage of prey in the more open portions of a hunting range. I tried to quantify this selective, open country hunting behavior at one site, Palma Vista, by conducting surveys of potential avian prey throughout this pairs' hunting range, and comparing the relative abundance of species detected on the surveys with frequency of each species taken to the nest as prey. These surveys were run between 31 May and 5 June 1966 by counting all birds of potential prey size that I saw or heard while walking along two transects, each ½ mile long, through the pairs' hunting range. The transects were designed to provide coverage of pinelands, hardwood hammocks, brushland and sawgrass marsh in correct proportion to the total area of these habitats in the hunting range. Each transect was walked on three different mornings, and the resulting counts provide rough estimates of the relative abundance of each species. The 19 prey-sized species recorded on these transects are presented in Table 2, with highest count for each as a measure of relative abundance. These counts revealed the two commonest open country species, Eastern Meadowlark and Red-winged Blackbird, made up 33% of available avian prey, but

TABLE 2
ABUNDANCE OF AVAILABLE PREY[1] COMPARED WITH FREQUENCY OF PREY IN A SHORT-TAILED HAWK NEST

Species	High field count	Percentage in field	Percentage in nest
Eastern Meadowlark	26	18.4	43.6
Red-winged Blackbird	21	14.8	25.0
Cardinal	19	13.5	6.3
White-eyed Vireo	14	9.9	6.3
Carolina Wren	12	8.5	—
Boat-tailed Grackle (*Cassidix major*)	9	6.3	—
Rufous-sided Towhee	8	5.7	—
Red-bellied Woodpecker (*Centurus carolinus*)	6	4.2	—
Pine Warbler (*Dendroica pinus*)	5	3.6	—
Yellow-billed Cuckoo	4	2.8	12.5
Mourning Dove	3	2.2	—
Common Yellowthroat (*Geothlypis trichas*)	3	2.2	—
Great Crested Flycatcher (*Myiarchus crinitus*)	2	1.4	—
Common Crow (*Corvus brachyrhynchos*)	2	1.4	—
Blue Jay (*Cyanocitta cristata*)	2	1.4	—
Black-whiskered Vireo	2	1.4	—
Pileated Woodpecker (*Dryocopus pileatus*)	1	0.7	—
Common Nighthawk (*Chordeiles minor*)	1	0.7	—
Eastern Kingbird (*Tyrannus tyrannus*)	1	0.7	—
Blackpoll Warbler	—	—	6.3

[1] For census methods see text.

were 68% (11 of 16) of the birds identified in the sample of prey collected at the nest that year. By comparison, three woodland and woodland edge species, Cardinal, White-eyed Vireo, and Carolina Wren (*Thryothorus ludovicianus*), which made up 32% of available prey, comprised less than 13% of prey identified in the nest. Presumably meadowlarks and blackbirds were taken in greater proportion than their relative abundance because of their conspicuousness in open country, and because the commonly employed aerial still-hunt technique along woodland edge results in a high percentage of capture attempts directed towards prey at the edge or in adjacent open country.

Prey collected at more recent nests also show selective hunting for open country species. Open country birds, Eastern Meadowlark, Red-

TABLE 3
SHORT-TAILED HAWK PREY AND HUNTING TECHNIQUES, CENTRAL AND SOUTH AMERICA

Location	Prey	Hunting techniques	Reference
Michoacán, Mexico	A small bird	—	Davis 1953
Veracruz, Mexico	Mostly small birds	"Make a dive in the air"	L. R. Wolfe pers. comm.
Colima, Mexico	—	Soar and stoop	Ogden field obs.
Costa Rica	Thrush-size birds	"*Falco*-like swoops"	Slud 1964
Panama	Brown Robin	"Stooped swiftly"	Wetmore 1965
Canal Zone	Two 14-inch ground lizards and a small bird	—	Hallinan 1924
Chacachacare Island, Trinidad	Ground Dove	Aerial hunting	Herklots 1961
Nariva Swamp, Trinidad	Dickcissel (*Spiza americana*)	Soar and stoop	Ogden field obs.
Surinam	Snakes, tree frogs, insects	—	Haverschmidt 1968
Guyana	Remains of unidentified bird in stomach	—	University of Miami No. 6217

winged Blackbird, a Bobwhite, a Bachman's Sparrow, and a Ground Dove made up about two-thirds (12 of 17) of the prey identified at the 1970 Rock Lake nest, and two marsh species, Red-winged Blackbird and Seaside Sparrow, were the predominant prey (12 of 14) at the 1972 Palma Vista nest.

FOOD HABITS OUTSIDE FLORIDA

Little is recorded about Short-tails in other portions of their range (Mexico south to northern Argentina and Chile), but available information on food habits and hunting technique is summarized (Table 3) for comparison with the Florida data. These data show a similiar high percentage of birds as prey, and include six observations of a soar and stoop hunting technique similar to that used in Florida. Haverschmidt's (1968) data from Surinam and Hallinan's (1924) from Panama suggest that in some parts of its range the diet is more diversified than I

found in Florida, perhaps related to the tropical Short-tails having available a greater abundance of large insects and reptiles than occurs in Florida. Still the hunting technique of tropical Short-tails is similar to that used in Florida, as I noted when watching several Short-tails hunting in Trinidad.

Discussion

Johnson and Peeters (1963) present seven physical and behavioral criteria for separating woodland and woodland edge buteos from open country buteos. By comparisons with woodland species, buteos of open country have more uniformly colored ventral plumages, longer wings, shorter tails, shorter tarsus, greater body size, frequently hunt by the soar and stoop technique, and have less varied diets. Short-tailed Hawks in Florida, and probably in most of their range, agree with five of the above criteria for open country buteos (solid ventral color, long wings, short tail, soar and stoop, and special prey). The apparent relation to open country buteos revealed by this sort of analysis is somewhat misleading. The Short-tail's long tarsi (and toes), which Johnson and Peeters consider to be a character of woodland buteos, as well as their proportionately long rounded wings, short broad tail, and the soar and stoop hunting technique probably all relate to their bird-hunting behavior rather than indicating this species to be a characteristic open country species.

Actually the Short-tail is not exclusively a woodland or open country bird, but throughout its total range apparently occupies a wide variety of habitats. I have watched Short-tails hunt for long periods over extensive forest in Trinidad, as well as over low thorn scrub and agricultural fields in Colima, Mexico. In Florida they hunt most frequently over woodland edge and open country almost certainly because of the character of the flat terrain and because birds are more conspicuous in these habitats than in woodland canopy, and not because this hunting technique is not effective over woods. The Short-tails I watched in Trinidad employed the same aerial still-hunting technique the Florida hawks used, by utilizing updrafts at the crests of forested ridges. My observations in these Trinidad forests showed small birds to be much more numerous in forest canopy there than in peninsular Florida woodland canopy.

Probably Short-tailed Hawks evolved their soar and stoop hunting technique as the only means by which a short-tailed, soaring hawk could exploit the relatively great numbers of canopy and forest edge birds available in tropical habitats. Other similarly shaped hawks that use the soar and stoop technique are open country species that hunt pri-

marily for mammals or reptiles on the ground (Brown and Amadon 1968; Brown 1971). Other broad-winged hawks that hunt small birds, e.g. *Accipiter* species, and African hawk-eagles *Hieraetus*, particularly *H. dubius* (Brown 1971), differ from Short-tails in being longer-tailed birds that often hunt from inconspicuous perches or by swift flight through or at the edge of woods. These species are particularly known for their agility at high speeds, an ability apparently lacking in Short-tailed Hawks.

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SUMMARY

This paper reports on migration, habitat, food habits, and hunting techniques of Short-tailed Hawks studied in Florida intermittently between 1966 and 1972. Short-tailed Hawks in south Florida are resident at nest sites, while Short-tails that summer, and presumably nest, in central and north Florida migrate into southern peninsula in October and return north in February. Short-tails are most common in mixed woodland-savannah habitats, where they find suitable nesting and roosting sites in stands of large trees and hunt primarily along woodland edge and over open country. Their preferred prey is small- to medium-sized birds, which they capture by a soar and stoop hunting technique. Hunting ranges are relatively large, and usually contain a high percentage of open country and a long, windward-facing woodland edge. In their total range Short-tails occur in both woodland and open country habitats, probably wherever the aerial hunting technique can be used efficiently to capture small birds.

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